

## Two New Species and Notes on Bornean *Praravinia* (Rubiaceae)

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Two new species of *Praravinia* (Rubiaceae) from Borneo, *P. longicalyx* Koizumi & Nagam. and *P. nitida* Koizumi & Nagam., are described and illustrated. Characters of the fruit of *P. subtomentosa* Bremek. are described for the first time. A new combination, *Urophyllum oresitrophum* (Bremek.) Koizumi & Nagam. based on *P. oresitropha* Bremek., is proposed and the original description is amended. A revised key to the Bornean species of *Praravinia* is provided.

Key words: Borneo, *Praravinia*, Rubiaceae, *Urophyllum*

*Praravinia* Korth. (Rubiaceae) is a genus of small dioecious trees that grow in primary and disturbed forests and in open places. Of the 49 described species, 23 occur in Borneo, 19 in the Philippine islands, and 7 in Sulawesi. *Praravinia* is allied to *Urophyllum* Jack ex Wall. and cannot be distinguished from *Urophyllum* only by vegetative characters. *Praravinia* differs from *Urophyllum* sensu Bremekamp in having fasciculate or solitary inflorescences (umbellate or solitary in the latter), sessile or subsessile flowers (pedicellate in the latter), heteromerous calyx and corolla (isomerous in the latter), and straight white hairs on the corolla throat (torulose pale yellow hairs in the latter) (Bremekamp 1940a, 1940b, 1940c). Based on phylogenetic analyses of DNA, *Maschalocorymbus* Bremek., *Pleiocarpidia* K. Schum., and *Pravinaria* Bremek. were recently subsumed under *Urophyllum* (Smedmark & Bremer 2011, Govaerts *et al.* 2016). *Urophyllum* is now more diverse, while *Praravinia* differs from it only in the heteromerous calyx and corolla. Molecular systematic studies suggest that *Praravinia* may not be phylogenetically separable from *Urophyllum*, although only one species of *Praravinia*, not the type species, was included in the analyses (Smedmark *et al.* 2008, Smedmark & Bremer 2011). Further study is necessary

to decide whether *Praravinia* should be included in *Urophyllum*.

Except for a few molecular studies, no taxonomic studies of *Praravinia* have been published since Bremekamp (1940a, 1940c), despite the fact that new material has been accumulated. Some couplets in the key developed by Bremekamp (1940a) have become irrelevant because of greater variation represented in the new material. Identifying the species of *Praravinia* is sometimes difficult, even with fertile material. The number of corolla lobes and ovary locules are among the most important characters in classifying the species of *Praravinia*. The corolla becomes considerably elongated during anthesis, but open flowers are rarely present on specimens of most species of *Praravinia*. The corolla is small and valvate in the flower buds, and great care is needed to dissect and count the corolla lobes. The berry needs to be dissected to determine the number of locules, but the dried fruit becomes soft to the center only after several hours in warm water.

For this study, we examined herbarium material held at BO, K, L, SAN, SAR, and SING. Two new species were discovered during the herbarium studies and are described here and an updated key to the species is presented, based on our find-

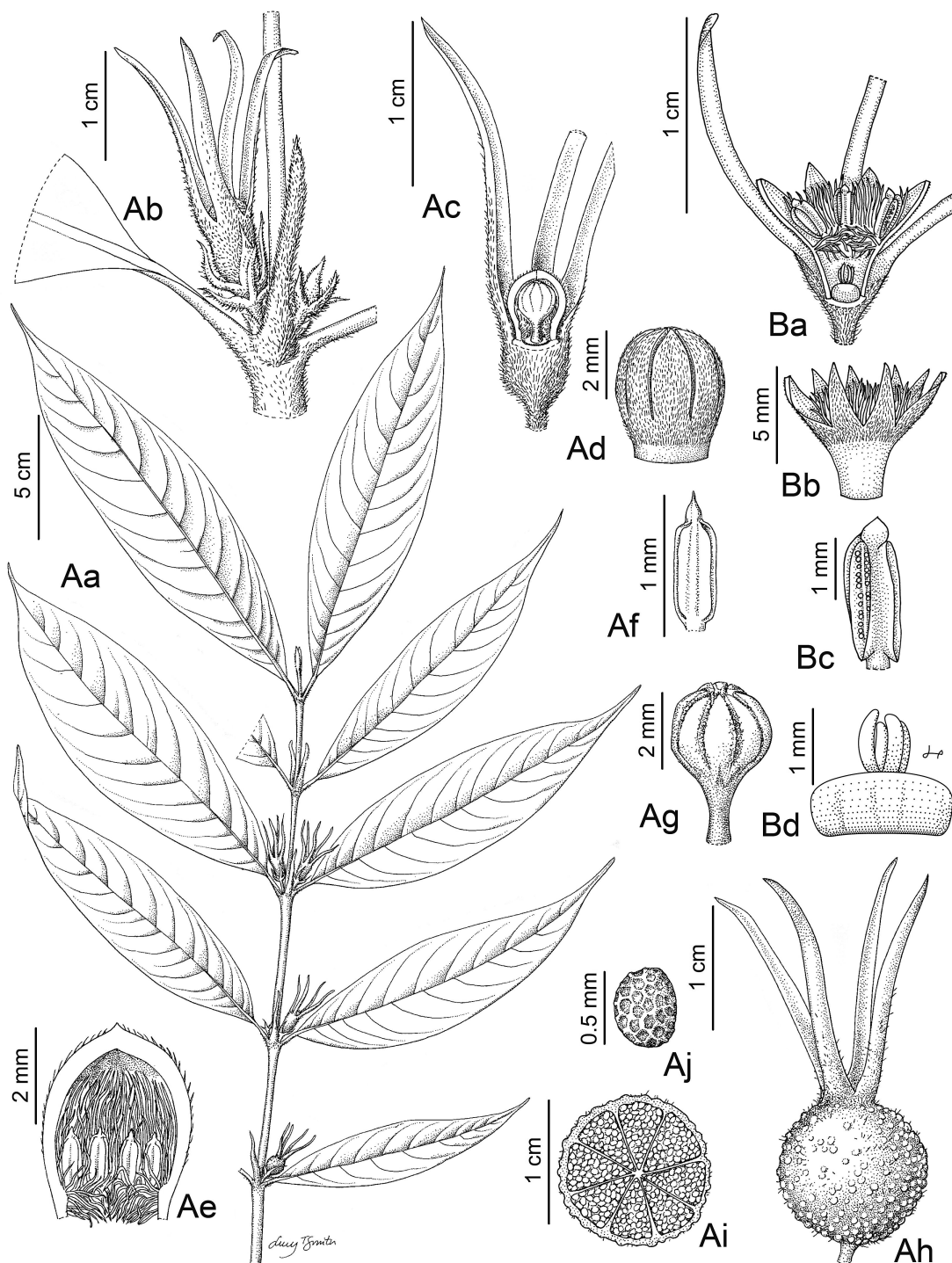


FIG. 1. *Praravinia longicalyx* Koizumi & Nagam. A: Carpellate plant. Aa: Branch with flower buds and young fruit. Ab: Inflorescence (flower in bud). Ac: Flower bud (calyx and corolla partly removed). Ad: Corolla from flower bud. Ae: Corolla and staminodia (corolla partly removed). Af: Staminode. Ag: Style and stigma. Ah: Fruit. Ai: Transverse section of fruit. Aj: Seed. B: Staminate plant. Ba: Flower (calyx and corolla partly removed). Bb: Corolla. Bc: Stamen. Bd: Stigma and disc. [Aa–Aj: *G. Shea* SAN 73414 (K). Ba–Bd: *Joseph B. et al.* SAN 123984 (SAN).]

ings. Where possible, we attempted to create couplets using characters that can be observed without dissection. Some species, however, can only be distinguished from other species by the number of corolla lobes, stigma lobes, or ovary locules.

***Praravinia longicalyx* Koizumi & Nagam., sp. nov.**—Fig. 1.

*Praravinia parviflorae* Bremek. et *P. verruculosae* Bremek. affinis sed differt involucellis extus pilosis, calycis lobis 8–28 mm longis (non usque 2 mm).

*Typus.* MALAYSIA. Sabah, Keningau, about 3/4 mile west of Kampong Batu Lungayan, 2300 ft., 15 November 1971, carpellate fl., fr., *G. Shea SAN 73414* (holo-K!; iso-L!, SAN!).

Trees, to ca. 8 m tall. Bark dark green or grayish; inner bark greenish or yellow; sapwood pale yellow. Twigs flattened when young, later terete, smooth or verruculose, very sparsely hairy or tomentose when young, glabrescent when old. Stipules narrowly triangular, 9–21 mm long, 1.5–2.5 mm wide, verruculose, sparsely hairy or tomentose outside, glabrous inside. *Leaves* petiolate; petiole 6–10 mm long, verruculose, sparsely hairy or tomentose; lamina firm chartaceous, narrowly elliptic or lanceolate, 8.1–23.5 cm long, 2.0–6.5 cm wide, length to width ratio 3.3–4.8, base cuneate or rounded, apex acuminate or acute, midrib sunken on upper surface, prominent on lower surface, lateral nerves 7–13 pairs, not looping or looping in distal part, faintly prominent on upper surface, prominent on lower surface, tertiary veins faintly prominent on upper surface, prominent on lower surface, upper surface glabrous, lower surface sparsely patent hairy on midrib and lateral nerves and sometimes on third order veins, drying pale grayish brown or pale green on both surfaces. *Inflorescences* in axils of leaves and sometimes also of upper leaf scars, sessile or with peduncle to ca. 2 mm long, 3–9-flowered fascicles in staminate, solitary in carpellate ones. Involucels 4-lobed, sparsely hairy or tomentose outside, glabrous inside, 2-whorled; cup in staminate ones ca. 1 mm long, lobes triangular, broadly triangular or depressed

ovate, 1–6 mm long, ca. 2 mm wide; cup in carpellate ones 1–2 mm long, lobes linear or narrowly triangular, 2–3.5 mm long, 0.8 mm wide in outer ones, 3–11 mm long, ca. 1 mm wide in inner ones. *Staminate flowers*: calyx 4-lobed, tube 2–3 mm long, 3–3.5 mm in diameter, tomentose or sparsely hairy, lobes linear, 8–15 mm long, ca. 1.5–2 mm wide, sparsely hairy outside, glabrous inside; corolla 6 or 8-lobed, tube 4 mm long, lobes 4–5 mm long, 1.7 mm wide, sparsely short hairy to tomentose outside on lobes and upper part of tube, glabrous inside except throat with long straight pointed whitish hairs; stamens 8, inserted on corolla throat, alternate with corolla lobes; filaments ca. 0.3 mm long, glabrous; anthers subbasifixed, introrse, oblong, ca. 1.8 mm long, glabrous; thecae opening by slit; connective dorsally enlarged, apical appendage ovate, ca. 0.3–0.4 mm long; disk depressed globose, ca. 1.8 mm in diameter, glabrous; stylodium ca. 0.8 mm long, basally 4-lobed, lobes linear. *Carpellate flowers* (known only from buds): calyx 4-lobed, tube 5–6 mm long, 3–4 mm in diameter, verruculose and tomentose or sparsely hairy, lobes linear, 9–28 mm long, 1.6–3.5 mm wide, sparsely hairy outside, glabrous inside; corolla 8-lobed, tube ca. 1 mm long, lobes 3.5 mm long, sparsely short hairy to tomentose outside on lobes and upper part of tube, glabrous inside except throat with long straight pointed whitish hairs; staminodia 8, inserted on corolla throat, alternate with corolla lobes; filaments ca. 0.1 mm long, glabrous; anthers subbasifixed, flattened, oblong, ca. 0.8 mm long, glabrous; connective dorsally enlarged, apical appendage ovate or triangular, ca. 0.1–0.2 mm long; disk annular, glabrous; style ca. 1.5 mm long, glabrous; stigma subglobose, ca. 2.5 mm in diameter, deeply 8-lobed, glabrous. *Fruit* subsessile, globose, ca. 12 mm in diameter, verruculose, sparsely minutely hairy (more so when young), orange at maturity, 8-celled. Seeds numerous.

*Distribution.* Sabah (western part).

*Habitat.* In disturbed hill forests, primary forests, on ridges and hillsides, along rivers, on silty-clay laterite (*G. Shea SAN 73414*) or ultrabasic soils (*Dewol Sundaling SAN 94923*), lowlands to 800 m alt.

*Additional specimens examined.* MALAYSIA. Sabah. Keningau Dist.: Hs. Trusmadi, staminate fl., *Joseph B. SAN 123984* (SAN); Crocker Range area, M 116, Jalan Kimanis, carpellate fl., *Asik Mantor SAN 116631* (SAN); Sahabat, C0 area, fr., *A. Karim Momin SAN 78343* (SAN); Wittig Range area, Sg. Labou, fr., *Fedilis Asik SAN 96351* (SAN); Ulu Sg. Tinagalan F. R., fr., *Asik Mantor SAN 113190* (SAN); Sg. Puntih, Mandalom F. R., fr., *Shawan Tangki SAN 120353* (SAN); Ulu Sg. Pingas, fr., *Sumbing Jimpin SAN 122047* (K, SAN). —Pensiangan Dist.: Bornion Timber camp 'C' Waiti Range, Tilulon, 800 m, fr., *Dewol Sundaling SAN 94923* (K, SAN); Sg. Mesopo, fr., *Sumbing Jimpin SAN 114027* (SAN); Sg. Pementarian, fr., *Asik Mantor SAN 119943* (SAN).

*Notes.* *Praravinia longicalyx* is vegetatively similar to *P. parviflora* and *P. verruculosa*, but can be easily recognized by the longer calyx lobes (8–28 mm long in *P. longicalyx*, to 2 mm long in *P. parviflora* and *P. verruculosa*). Another distinction is that the outside of the involucels is hairy in *P. longicalyx* and glabrous in *P. parviflora* and *P. verruculosa*.

***Praravinia nitida* Koizumi & Nagam., sp. nov.**  
—Fig. 2.

*Praraviniae borneensi* (Merr.) Bremek. affinis sed differt foliis supra nitidis, inflorescentiis masculinis 1- vel 2-floribus (2–10-floribus in *P. borneensi*), connectivi appendice ovata (non lineari), disco floris masculini plano (non conico).

*Typus.* MALAYSIA. Sarawak, Bintulu, Nyabau catchment area, 14 June 1966, staminate fl., *Sibat ak Luang S 24541* (holo-SAR!; iso-A, BO!, FHO, K!, KEP, LI, MEL, SAN!, SING!).

Trees, to ca. 6 m tall; trunk to 5 cm in diameter. Twigs terete or slightly 4-ridged, smooth or slightly verruculose, sparsely hairy or tomentose when young, glabrescent when old. Stipules narrowly triangular, (8–)14–22 mm long, 2–3 mm wide, hairy outside, hairy or glabrous inside. *Leaves* petiolate; petiole 11–22 mm long, usually verruculose, tomentose or sparsely hairy; lamina chartaceous, flat or sometimes bullate, elliptic or narrowly elliptic, 13–28 cm long, 3.7–9.5 cm wide, length to width ratio 2.8–4.9, usually widest at slightly above middle, base cuneate, apex

acuminate (or caudate), midrib sunken on upper surface, prominent on lower surface, lateral nerves 11–16 pairs, looping at least in distal part, sunken or flat on upper surface, prominent on lower surface, tertiary veins faintly prominent on upper surface, prominent on lower surface, upper surface glossy and glabrous except on midrib and sometimes also lateral nerves, lower surface sparsely patent hairy, midrib, lateral veins, and tertiary veins drying paler than lamina. *Inflorescences* in axils of leaves and/or upper leaf scars, sessile or with peduncle to ca. 1 mm long, solitary or 2-flowered fascicles in both staminate and carpellate ones; each flower with two involucels. Involucels slightly, moderately, or almost basally 4-lobed, rarely entire, lobes narrowly triangular, triangular, broadly ovate, or depressed ovate, apex acute or rounded, sparsely hairy outside, tomentose inside, 2-whorled; outer whorl in staminate ones 1.4–3 mm long, inner whorl 2.3–4 mm long including lobes; outer whorl in carpellate ones 2–4 mm long, inner whorl 3.5–5.7 mm long including lobes. *Staminate flowers* (known only from buds): calyx 4-lobed, tube 3–4 mm long, lobes depressed ovate, 1.5–2 mm long, 3–4.5 mm wide, apex acute or rounded, sparsely hairy outside, tomentose inside; corolla 8-lobed, tomentose to sparsely hairy outside on lobes and upper part of tube, glabrous inside except throat with long straight pointed whitish hairs. Stamens 8, inserted on corolla throat, alternate with corolla lobes; filaments ca. 0.1 mm long, glabrous; anthers subbasifixed, introrse, oblong, ca. 1.6 mm long, glabrous; thecae opening by slit; connective dorsally enlarged, apical appendage ovate, ca. 0.4 mm long; disk flat, ca. 2 mm in diameter, glabrous; stylodium ca. 0.5 mm long, basally 4-lobed, lobes linear. *Carpellate flowers* unknown. *Fruit* with pedicel 3–4 mm long, globose (but appearing ellipsoid with calyx limb when young), 12–16 mm long, 12–15 mm in diameter, sparsely hairy (more densely hairy when young), light brown (fide *Sibat ak Luang S 24590*) or pale orange (fide *Ashton S 18307*) at maturity, 8-celled. Seeds numerous.

*Distribution.* Sarawak (Bintulu and Mukah Districts).



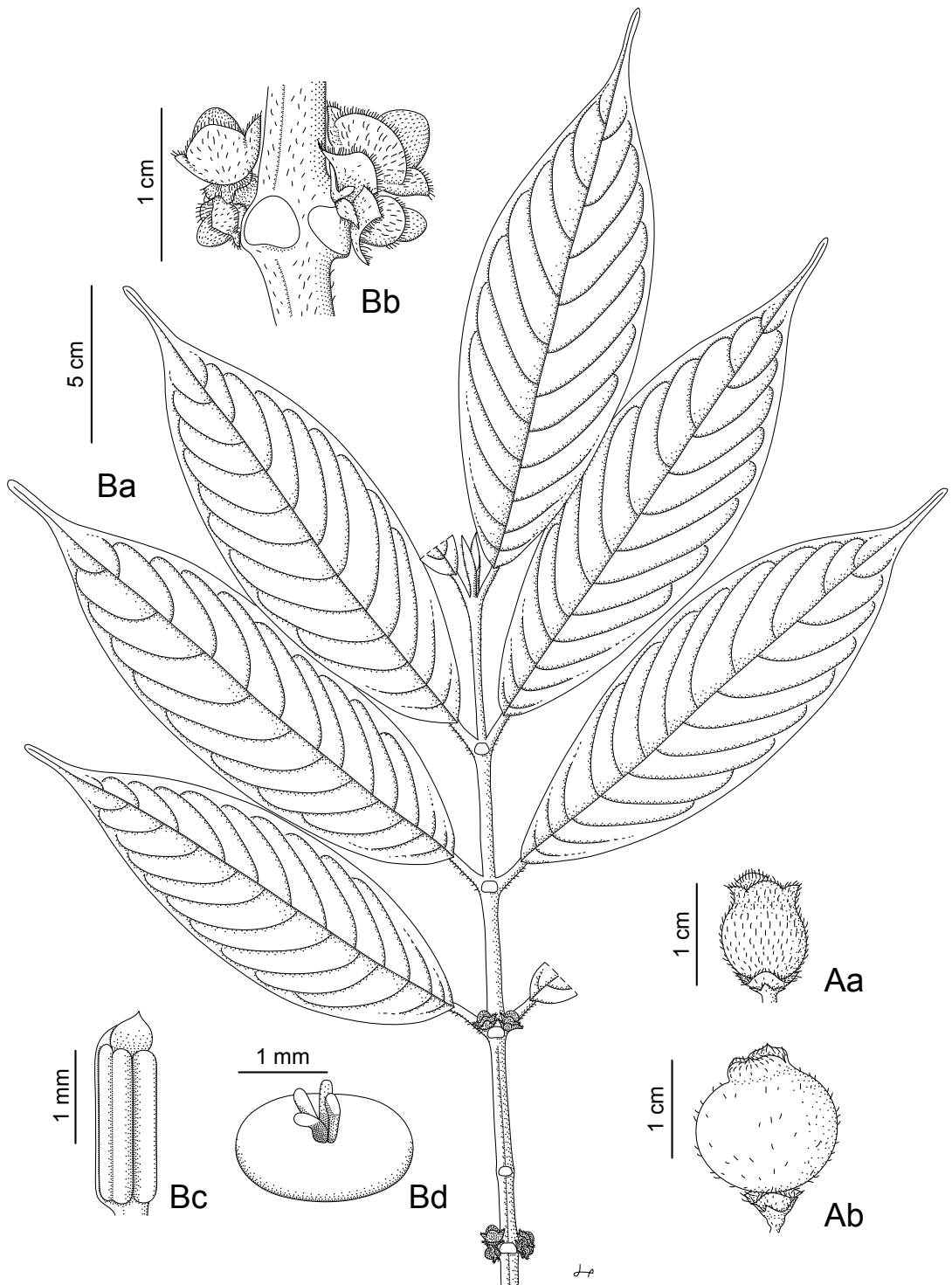


FIG. 2. *Praravinia nitida* Koizumi & Nagam. A: Carpellate plant. Aa: Young fruit. Ab: Mature fruit. B: Staminate plant. Ba: Branch with flower buds. Bb: Inflorescence (flowers in bud). Bc: Stamen. Bd: Stigma and disc. [Aa: *Sibat ak Luan S 23672* (SAR). Ab: *Sibat ak Luan S 24590* (SAR). Ba–Bd: *Sibat ak Luan S 24541* (SAR).]

**Habitat.** In mixed dipterocarp forests, sea-side, near streams, on ridges and hillslopes, on sandy clay soil, 0–300 m alt.

**Additional specimens examined.** MALAYSIA. Sarawak. Bintulu Dist.: Nyabau catchment area, 300 ft., fr., *Sibat ak Luang S 24590* (BO, K, L, SAN, SAR); Nyabau F. R., fr., *Brain ak Tada S 14493* (K, L, SAN, SAR); Ulu Segan, 900 ft., fr., *Wright S 27182* (K, L, SAN, SAR); Ulu Sinrok, Similajau F. R., fr., *Ashton S 18307* (K, L, SAN, SAR). —Mukah Dist.: Balingian, Ulu Sg. Arip, Bkt. Iju, 400 ft., fr., *Sibat ak Luang S 23672* (K, L, SAN, SAR); *ibidem*, 500 ft., fr., *Jugah ak Kudi S 23750* (K, L, SAN, SAR); *ibidem*, fr., *Jugah ak Kudi S 23725* (K, L, SAN, SAR); *ibidem*, 350 ft., fr., *Wright S 23608* (K, L, SAN, SAR).

**Notes.** *Praravinia nitida* is vegetatively similar to *P. borneensis* except for the shiny upper surface of the leaves, but significantly differs from *P. borneensis* in characteristics of the reproductive organs. The staminate inflorescences of *P. nitida* are 1 or 2-flowered, each of which is separately involuclate. The staminate inflorescences of *P. borneensis* are 2–10-flowered, which are often in triads (every three flowers subtended by shared involucels, and each lateral flower further involuclate). The calyx limb of the fruit also tends to be shorter in *P. nitida* (2.1–2.7 mm long in *P. nitida*, 2.2–4.6 mm long in *P. borneensis*). Furthermore, the apical appendage of the connective is ovate in *P. nitida* and linear in *P. borneensis*; the disk of the staminate flowers is flat in *P. nitida* and conical in *P. borneensis*.

### **Praravinia subtomentosa** Bremek.

*Praravinia subtomentosa* Bremek. in Recueil Trav. Bot. Néerl. 37: 248 (1940); et in Meded. Bot. Mus. Herb. Rijks Univ. Utrecht, No. 78, 248 (1940). —*Typus*. INDONESIA. North Kalimantan, B. Ulu Sebuk, 1912, staminate fl., *Amdjah 466* (holo-BO!).

Trees, to 10 m tall. Bark brown. Twigs flattened at first, becoming slightly 6- or 4-ridged or terete, tomentose. Stipules narrowly triangular, 17–33 mm long, 3–7 mm wide, tomentose on both surfaces. Leaves petiolate; petiole 7–12 mm long, tomentose; lamina subcoriaceous, narrowly elliptic or elliptic, (5–)11–24 cm long, (1.5–)3–6 cm wide, base cuneate, apex acuminate, midrib

sunken on upper surface, prominent on lower surface, lateral nerves (9–)18–21 pairs, not looping or looping in distal part, flat on upper surface, prominent on lower surface, tertiary veins invisible on upper surface of mature leaves, prominent on lower surface, upper surface glabrous except on midrib, lower surface villose, midrib and lateral nerves totally covered by long hairs, reticulate veins also with long hairs, drying greenish or brown. *Inflorescences* in axils of lower leaves and/or leaf scars, subsessile, solitary or 2- or 3-flowered fascicles in staminate, solitary in carpellate ones. Involucels 4-lobed, tomentose on both surfaces, lobes depressed ovate or ovate, apex acute or rounded, 2-whorled; cup of outer whorl 1–3 mm long, lobes 1.5–3 mm long, 2–3 mm wide; cup of inner whorl 1–4 mm long, lobes 2–5 mm long, 4–6 mm wide. *Staminate flowers*: calyx 4-lobed, tomentose on both surfaces, tube 3–5 mm long, lobes depressed ovate, 3–6.5 mm long, 6–7.5 mm wide, apex acute or rounded; corolla 8-lobed, tomentose outside, tube 4.5 mm long (immature), lobes 5.3 mm long, 2 mm wide; anthers 2.8 mm long; connective dorsally enlarged, apical appendage 0.7 mm long; stylodium 2 mm long, 8-lobed, lobes short. *Carpellate flowers* insufficiently known; calyx 4-lobed. *Infructescences* subsessile; cup of outer involucels 3–4 mm long, lobes ovate or depressed ovate, 6–7 mm long, 6–8 mm wide, apex acute or rounded; cup of inner involucels 4 mm long, lobes broadly ovate or depressed ovate, 3–8 mm long, 4–11 mm wide, apex acute or rounded. *Fruit* with pedicel to 5 mm long, globose, 10–15 mm long, 16–20 mm in diameter, tomentose, 16-celled; calyx lobes depressed ovate, to 6 mm long, 10 mm wide, apex acute, rounded or emarginate. Seeds numerous.

**Distribution.** Sabah (southern part) and North Kalimantan.

**Habitat.** Primary forests, ridge sides, hilltops; 300–500 m alt.

**Additional specimens examined.** MALAYSIA: Sabah. Pensiangan Dist.: Tambulanan, staminate fl., *Amin & Suali SAN 68990* (K, SAN); Sepulut, Sg. Saburan, carpellate fl., *Omar Musi SAN 106902* (SAN); *ibidem*, inside RP474, fr., *Leopold Madani SAN 114405* (SAN); *ibidem*,

Sg. Siburan, fr., *Leopold, Joseph, Maikin SAN 114437* (SAN); *ibidem*, trail to Rafflesia, 325 m, fr., *J. Kulip S. SAN 133525* (K, SAN); *ibidem*, Tibau, fr., *Postar M. & Jemson J. SAN 152951* (SAN). INDONESIA. North Kalimantan. Pujungan Dist.: Kayan-Mentarang N. R., Gong River, ca. 1 km from confluence with Bahau River, base camp of WWF, 2°50'N, 115°50'E, 425–450 m, fr., *J. A. McDonald & Ismail 3460* (BO).

**Notes.** *Praravinia subtomentosa* was described based only on the type specimen (staminate plant). Here we describe the fruit as well as other characters, but hesitate to dissect the staminate flowers because only two specimens are known. We follow Bremekamp (1940a) for the description of the staminate flowers. The involucls, pedicels, and calyx lobes enlarge after flowering and thus the description of the inflorescences and infructescences are given separately. *Praravinia subtomentosa* is similar to *P. polymera* Bremek., but *P. polymera* has triangular calyx lobes that form a beak at the apex of the fruit.

***Urophyllum oresitrophum* (Bremek.) Koizumi & Nagam., comb. nov.**

Basionym: *Praravinia oresitrophia* Bremek. in *Recueil Trav. Bot. Néerl.* 37: 255 (1940); et in *Meded. Bot. Mus. Herb. Rijks Univ. Utrecht*, No. 78, 255 (1940). —*Typus*. MALAYSIA. Sabah, Mt. Kinabalu, 8000 ft., 14 December 1933, staminate fl., *J. & M. S. Clemens 51105* (holo-L!; iso-A, BM, K!).

**Distribution.** Sabah (Mt. Kinabalu).

**Additional specimen examined.** MALAYSIA. Sabah. Mt. Kinabalu, eastern shoulder, 6°05'N, 116°36–40'E, 9500 ft., staminate fl., *Chew, Corner & Stainton 789* (K, SAR).

**Notes.** *Urophyllum oresitrophum* is so far known only from two collections of staminate plants from Mt. Kinabalu (2400–2900 m alt.). The holotype, *Clemens 51105* (L), has a young inflorescence. The pedicels were described as 1–6 mm long in the original description. Although a pedicel length of 6 mm is exceptionally long in *Praravinia*, the overall morphology of the inflorescence gives the impression that it can be a species of *Praravinia*. The developed inflorescence of one of the isotypes, *Clemens 51105* (K), however, is a distinct umbel, which is never observed

in species of *Praravinia*. Moreover, the original description appears to be based on flowers of a different species, though it generally agrees with the vegetative characters of the types. Contrary to the statement in the original description that the calyx is 4-lobed, in *Clemens 51105* (K, L) the calyx is 5-lobed. The flowers of *Chew, Corner, & Stainton 789* (K) also have the 5-lobed corolla with torulose pale yellow hairs on the throat. We thus conclude that *P. oresitrophia* should be transferred to *Urophyllum*.

Amended description of the flowers is as follows. *Staminate inflorescences* with peduncle ca. 1 mm long, umbellate. *Staminate flowers* pedicellate; pedicels 5–12 mm long, sparsely hairy to tomentose; calyx 5-lobed, sparsely hairy to tomentose outside, glabrous inside, cup 3.5 mm long, lobes triangular, 2 mm long, apex acuminate or acute; corolla 5-lobed, tube 7 mm long, lobes triangular, 4–5 mm long, 2–3.5 mm wide, glabrous on tube and sparsely short hairy to tomentose towards apex of lobes outside, glabrous inside except throat with long torulose pale yellow hairs; stamens 5, inserted on corolla throat; filaments ca. 0.9 mm long; anthers dorsifixed, ca. 2.1 mm long; apical appendage of connective emarginate, ca. 0.5 mm long; disk conical, ca. 1 mm long; stylodium ca. 2 mm long, 3-lobed near base, lobes linear.

## Problematic taxa

***Praravinia sericotricha* Bremek.**

*Praravinia sericotricha* Bremek. in *Recueil Trav. Bot. Néerl.* 37: 257 (1940); et in *Meded. Bot. Mus. Herb. Rijks Univ. Utrecht*, No. 78, 257 (1940). —*Typus*. MALAYSIA. Sabah, Mt. Kinabalu, Tenompok, 5000 ft., 26 April 1932, carpellate fl., fr., *J. & M. S. Clemens 28735* (holo-BO!; iso-A, K!, L!, SING).

***Praravinia chalcotricha* Bremek.**

*Praravinia chalcotricha* Bremek. in *Recueil Trav. Bot. Néerl.* 37: 258 (1940); et in *Meded. Bot. Mus. Herb. Rijks Univ. Utrecht*, No. 78, 258 (1940). —*Typus*. MALAYSIA. Sabah, Mt. Kinabalu, Mt. Nunkok, 4000 ft., 14 April 1933, staminate fl., *J. & M. S. Clemens 32824* (holo-BO!; iso-A, L!).

Bremekamp (1940a) distinguished *Praravinia sericotricha* and *Praravinia chalcotricha* by number of corolla lobes (8 in all flowers in the former, 8 in the carpellate and the central staminate flowers and 6 in the lateral staminate flowers in the latter), color of indumentum (the former gray silky, the latter brown silky), and shape of lamina (the former “lineari-oblonga vel lineari-oblongeolata,” the latter “oblonga vel oblongeolata”; but based on our observation of the specimens cited by him, the former narrowly elliptic or narrowly obovate, the latter elliptic or obovate). We examined 22 specimens (37 sheets) that could be identified as either *P. sericotricha* or *P. chalcotricha*. Our examination suggests that vegetative characters are not diagnostic. The color of the indumentum and the shape of the lamina are not correlated. For instance, in *Yii Puan Ching S 44655* (L, SAR) the indumentum is brown silky, but the lamina is narrowly obovate. The color of the indumentum or the shape of the lamina sometimes varies, even within an individual. *Hansen 464* (SAR), for example, has one pair of stipules with whitish hairs and two pairs with brown hairs. The remaining diagnostic character, the number of corolla lobes of the lateral staminate flowers, needs to be examined to determine if the number is stable within an individual.

#### ***Praravinia sericotricha* Bremek.**

*Praravinia sericotricha* Bremek. in Recueil Trav. Bot. Néerl. 37: 266 (1940); et in Meded. Bot. Mus. Herb. Rijks Univ. Utrecht, No. 78, 266 (1940). —*Typus*. INDONESIA. West Kalimantan, Müller Mts., Liang Gagang, 1894, staminate fl., *Hallier 2728* (holo-BO!; iso-L!).

#### ***Praravinia sericotricha* Bremek.**

*Praravinia sericotricha* Bremek. in Recueil Trav. Bot.

Néerl. 37: 267 (1940); et in Meded. Bot. Mus. Herb. Rijks Univ. Utrecht, No. 78, 267 (1940). —*Typus*. MALAYSIA. Sabah, Mt. Kinabalu, Penibukan, 4000 ft., 9 September 1933, staminate fl., *J. & M. S. Clemens 40360* (holo-BO!; iso-A, BM, L!).

Bremekamp (1940a) used shape, size, and color of the leaves and size and hairs of the stipules in the key to distinguish *Praravinia parviflora* from *P. verruculosa*, *P. salicifolia* Bremek., and *P. gracilis* Bremek. Among these four species, *P. salicifolia* can easily be identified by its linear or narrowly elliptic lamina. Among the remaining three species, *P. gracilis* can be identified by its smaller lamina, dense hairs on the inner surface of the calyx, acute apex of the calyx lobes, and fewer ovary locules. The problem is in distinguishing *P. parviflora* and *P. verruculosa*. In our examination of 69 specimens (73 sheets) that were mostly likely to be identified as either of these two species, the characters in the key were not well correlated. According to Bremekamp's description, the calyx tube of the staminate flowers is 2.5 mm long in *P. parviflora* and 6 mm long in *P. verruculosa*, but many specimens have the calyx of an intermediate length. Judging from the morphology of the appendage and the disk, there may be more than two species represented in the specimens we examined. Further studies are needed to determine the taxonomic status of these plants.

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Key to the species of *Praravinia* in Borneo

- 1 a. Flowers cauliflorous (born on the trunk and old branches); calyx 5-lobed, rarely 4-lobed [trunk deeply fissured and corky; Brunei, Sabah, North Kalimantan (Kutai)] ..... *P. suberosa* (Merr.) Bremek.
- 1 b. Flowers in axils of leaves or upper leaf scars; calyx 4–6-lobed or lobes inconspicuous ..... 2
- 2 a. Calyx 5- or 6-lobed in staminate flowers, 4- or 5-lobed in carpellate flowers [sparsely hairy outside; calyx lobes 7–9 mm long, 6–9 mm wide; lamina papery; West and East Kalimantan] ..... *P. densiflora* Korth.
- 2 b. Calyx 4-lobed in staminate and carpellate flowers or lobes inconspicuous ..... 3
- 3 a. Lower surface of lamina with long straight silky hairs and felt-like tiny hairs (tiny hairs visible only with binoculars [ $\times 180$ ]) ..... 4
- 3 b. Lower surface of lamina glabrous or with non-silky indumentum of more or less long hairs (straight or not) ..... 8
- 4 a. Staminate inflorescences solitary; calyx lobes of staminate flowers 8–9 mm long, 3 mm wide (carpellate flowers unknown) [Sarawak (base of Mt. Murud), once collected] ..... *P. sarawacensis* Bremek.
- 4 b. Staminate inflorescences 3-flowered (unknown in *P. hexamera*); calyx lobes of staminate and carpellate flowers less than 8 mm long (staminate flowers unknown in *P. hexamera*), if longer, then wider than 4 mm ... 5
- 5 a. Upper surface of mature leaves drying light brown; fruit 5- or 6-celled [lateral nerves 11–16 pairs; Sarawak, West and North Kalimantan] ..... *P. hallierii* Bremek.
- 5 b. Upper surface of mature leaves drying brown or dark brown; fruit 7- or 8-celled ..... 6
- 6 a. Buds of carpellate flowers narrowly ellipsoid, length to diameter ratio ca. 3 (staminate flowers unknown); corolla of carpellate flowers 6-lobed [lateral nerves (16–)18–25(–29) pairs; Sarawak, West and East Kalimantan (also in North Kalimantan?)]] ..... *P. hexamera* Bremek.
- 6 b. Staminate and carpellate flower buds ovoid or ellipsoid, length to diameter ratio usually less than 2; corolla of carpellate flowers 8-lobed ..... 7
- 7 a. Corolla of all flowers 8-lobed ..... *P. sericotricha* Bremek.
- 7 b. Corolla of lateral staminate flowers 6-lobed, of central staminate flowers and carpellate flowers 8-lobed ..... *P. chalcotricha* Bremek.
- 8 a. Calyx lobes linear, 8–28 mm long, sparsely hairy outside [Sabah (western part)] ..... ***P. longicalyx*** Koizumi & Nagam.
- 8 b. Calyx lobes not linear (variously ovate, rounded, variously triangular, or inconspicuous), less than 8 mm long, or if longer, then densely hairy outside ..... 9
- 9 a. Third order veins on lower surface of lamina glabrous ..... 10
- 9 b. Third order veins on lower surface of lamina sparsely to densely hairy ..... 17
- 10 a. Stipules more than 5 mm wide; lamina coriaceous ..... 11
- 10 b. Stipules 1–4.5 mm wide; lamina papery to thinly coriaceous ..... 12
- 11 a. Lobes of involucrel to 1.5 mm long; calyx lobes of staminate flowers 1 mm long; corolla lobes of staminate flowers 5.5 mm long; lamina completely glabrescent [Sabah (Mt. Kinabalu), 1200–1500 m alt.] ..... *P. coriacea* Bremek.
- 11 b. Lobes of involucrel 4.5–10 mm long; calyx lobes of staminate flowers 4 mm long; corolla lobes of staminate flowers 10 mm long; midrib on lower surface of lamina very sparsely hairy [Sabah (Mt. Kinabalu), 1700–2400 m alt.] ..... *P. bullata* Bremek.
- 12 a. Calyx nearly smooth and glabrous outside, lobes rounded or calyx truncate [Sabah] ..... *P. havilandii* (Ridl.) Bremek.
- 12 b. Calyx verruculose (i.e., with warty surface) or hairy outside, lobes rounded, ovate, or triangular ..... 13
- 13 a. Calyx of staminate flowers smooth and hairy outside (carpellate flowers unknown); lateral nerves ca. 15 pairs [Sabah (Payau River), once collected] ..... *P. nerifolia* Bremek.
- 13 b. Calyx verruculose or if smooth then lateral nerves 11 pairs or less ..... 14
- 14 a. Length to width ratio of lamina 5 or more; corolla of staminate flowers 6-lobed [Sarawak, Sabah? (*A. Baker SAN 26172*)] ..... *P. salicifolia* Bremek.
- 14 b. Length to width ratio of lamina less than 5; corolla of staminate flowers 6–8-lobed ..... 15
- 15 a. Calyx densely hairy inside; corolla of staminate flowers 6- or 7-lobed [Sabah (also in Brunei?)] ..... *P. gracilis* Bremek.
- 15 b. Calyx sparsely hairy inside, sometimes densely hairy only toward base; corolla of staminate flowers 8-lobed ..... 16
- 16 a. Stigma of staminate flowers 8-lobed [West Kalimantan] ..... *P. parviflora* Bremek.
- 16 b. Stigma of staminate flowers few-branched (fide Bremekamp 1940a) [Sabah] ..... *P. verruculosa* Bremek.
- 17 a. Midrib and lateral veins on lower surface of lamina mostly with spreading hairs ..... 18
- 17 b. Midrib and lateral veins on lower surface of lamina mostly with appressed hairs ..... 21

- 18a. Calyx limb (lobes inconspicuous) to ca. 1 mm long in fruit; lamina thinly coriaceous, length to width ratio ca. 4 or more [Sabah] ..... *Praravinia creaghii* (Ridl.) Bremek.
- 18b. Calyx limb (lobes conspicuous or not) 2 mm long or more in fruit; lamina thinly coriaceous or papery, length to width ratio 2.2–4.9, usually less than 4 ..... 19
- 19a. Flower buds narrowly ovoid or narrowly rectangular, ca. 9 mm long, 3 mm in diameter; calyx lobes in fruit, ca. 6 mm long, recurved [Sabah] ..... *P. mollis* Bremek.
- 19b. Flower buds ovoid, ellipsoid, or globose, 5–7 mm long, 3–7 mm in diameter; calyx lobes in fruit ca. 2 mm long, spreading or erect ..... 20
- 20a. Upper surface of lamina glossy; staminate inflorescences 1- or 2-flowered; apical appendage of connective of staminate flowers ovate, disk flat [Sarawak (Bintulu and Mukah)] ..... *P. nitida* Koizumi & Nagam.
- 20b. Upper surface of lamina dull; staminate inflorescences (2–)3–7(–10)–flowered; apical appendage of connective of staminate flowers linear, disk conical [Brunei, Sarawak (Lawas), Sabah, East and North Kalimantan] ..... *P. borneensis* (Merr.) Bremek. (part)
- 21a. Lamina papery ..... 22
- 21b. Lamina thinly coriaceous ..... 23
- 22a. Calyx lobes of staminate and carpellate flowers and fruit broadly ovate, depressed ovate, broadly triangular or depressed triangular, less than 3 mm long, 4 mm wide ..... *P. borneensis* (Merr.) Bremek. (part)
- 22b. Calyx lobes of carpellate flowers and fruit (staminate flowers unknown) depressed ovate, more than 5 mm long, 7 mm wide [East Kalimantan (Kutai) (also in Sarawak?)] ..... *P. megistocalyx* Bremek.
- 23a. Calyx lobes in fruit (flowers unknown) narrowly triangular, 8–10 mm long, 2–3 mm wide [Central Kalimantan (Muara Teweh), once collected] ..... *P. urophyllodes* Valetton
- 23b. Calyx lobes in flowers and fruit triangular, ovate, broadly ovate, or depressed ovate, 3–7 mm long, 4–10 mm wide ..... 24
- 24a. Calyx lobes in carpellate flowers and fruit (staminate flowers unknown) triangular, ovate, or broadly ovate, 6–7 mm long, 4–5 mm wide, apex acute, enclosing apex of fruit [South and East Kalimantan] ..... *P. polymera* Bremek.
- 24b. Calyx lobes in staminate and carpellate flowers and fruit depressed ovate, apex acute, rounded, or emarginate, 3–6.5 mm long, 6–10 mm wide, not enclosing apex of fruit [Sabah (southern part), North Kalimantan] ..... *P. subtomentosa* (Merr.) Bremek.

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